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November 27, 2006

Attorney Docket No. 2000.180 ***PATENT***

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
Sengupta, et al

Art Unit: 1723

Serial No. 10/812,450

Examiner: Menon, Krishnan S.

Filed: March 30, 2004

For: THREE PORT HIGH PERFORMANCE MINI HOLLOW FIBER MEMBRANE CONTACTOR

DECLARATION UNDER RULE 132

I, Amitava Sengupta, declare:

1. I am a named inventor in the above captioned application.

2. I have a Masters of Technology in Chemical Engineering from the Indian Institute of Technology and a PhD in Chemical Engineering from the Stevens Institute of Technology.

3. I have over 22 years of experience in the manufacture and use of membrane contactors.

4. In the Office Action mailed October 13, 2006, the Examiner states, with regard to Cho et al (US 6,616,841):

> "The core is plugged on one end (by the tube sheet (26), but is not the same end as claimed, which eliminates the 'first' end cap in the reference figure 4. However, this difference in the claims is only an obvious equivalent of the teaching of the reference unless applicant can show otherwise, with evidence."

5. I respectfully disagree with that conclusion. Making a membrane contactor with the center tube plugged at the end where the hollow fiber lumens are open and having the center tube open at the end where the hollow fiber lumens is closed was not obvious to one skilled in the art in view of Cho at the time of filing the instant application.

6. Making a membrane contactor with the center tube plugged at the end where the hollow fiber lumens are open and having the center tube open at the end where the hollow fiber lumens is closed allows a much simpler way to manufacture the membrane contactor and allows the membrane contactor to be made out of the same material. This configuration allows a membrane contactor to be manufactured more simply with a single weld between the end caps and the shell, thus, eliminating the dual welding step of simultaneously welding the edges of the end caps to the shell and welding the end cap to the center tube.

7. Numerous patents have been filed regarding membrane contactors. Many of these patents use different techniques to seal the end caps to the shell and tube sheets. However, none of the patents disclose a membrane contactor that solves the problem of sealing the end caps to the shell by a single welding step.

8. On December 31, 1991 Prasad (US Patent No. 5,264,171) was filed for a method of making spiral wound hollow fiber membrane fabric cartridges and modules having flow-directing baffles. Referring to Figures 17 and 18, Prasad teaches a membrane contactor that uses O-rings for sealing the end caps to the shell and the shell to the tube sheets. (Column 13, Lines 52-61). Prasad does not disclose welding the end caps to the shell by a single welding step.

9. On December 31, 1992 Huang (US Patent No. 5,284,584) was filed for a hollow fiber membrane fabric-containing cartridges and modules having solvent-resistant thermoplastic tube sheets, and methods for making the same. Referring to Figure 6, like Prasad above, Huang teaches a membrane contactor that uses O-rings for sealing the end caps to the shell and the shell to the tube sheets. (Column 21, Lines 58-67). Huang does not disclose welding the end caps to the shell by a single welding step.

10. On December 7, 1998 Carroll (US Patent No. 6,207,053) was filed for a thermoplastic unibody transfer device. Referring to Figure 2, Carroll teaches welding the end cap to the shell using a sealing ring (or weld piece), and to the center tube. (Column 3, Lines 8-13). Because welding between dissimilar materials is more difficult than welding between similar materials, Carroll teaches using the sealing ring, or weld piece, to simplify the welding between the dissimilar materials of the center tube, shell and end caps. (Column 3, Lines 14-24). Carroll requires a dual welding step of simultaneously welding the end caps to the shell (weld 26) and the end cap to the center tube (weld 28). Carroll does not disclose welding the end caps to the shell by a single welding step.

11. On May 8, 2001 Runkle (US Patent Publication No. 2002/0168491) was filed for a hollow fiber membrane contactor and method for making the same. Runkle teaches a membrane contactor with a first potting step for sealing the tube sheets to the shell and a second potting step for sealing the end caps to the shell and tube sheets. (Paragraphs 20-29). Runkle teaches using a dual potting technique for sealing the end caps to the shell, thus, Runkle does not disclose welding the end caps to the shell by a single welding step.

12. On June 21, 2001 Cho (US Patent No. 6,616,841) was filed for a hollow fiber membrane contactor. Cho is directed toward making a hollow fiber membrane contactor with a polymethyl pentene (PMP) hollow fiber. (Column 2, Lines 8-29). Cho is not directed and makes no mention of seals or welds between the end caps and the shell. As illustrated in Figures 1, 3 and 4, Cho shows different configurations of membrane contactors that all require a dual welding step. Thus, Cho does not disclose welding the end caps to the shell by a single welding step.

13. My experience leading up the instant invention tells me that a person skilled in the art of membrane contactors would not look to Cho for solving the problem of sealing the end caps to the shell with a single welding step.

14. The dual welding step, required prior to the instant invention, was difficult to accomplish because the extremely tight dimensional tolerances needed to thermally weld at two different locations simultaneously are hard to achieve, as anyone skilled in the art can attest, leading to low product yield. The dual-welding technique used for membrane contactor designs used prior to the instant invention, as illustrated in Carroll, Runkle, and Cho, require one 'butt'-welding at one location (between the end cap and the shell) and a second 'butt' or 'lap'-welding at the other

location (between the end cap and the center tube). The welding may be perfect between the end cap and the shell but insufficient between the end cap and the center tube, and vice versa. It has been my experience that such dual-welded membrane contactors often fail in the field at one or the other weld locations when subjected to extremes of temperatures, to high pressures, and to organic solvents that cause swelling in the polymeric components.

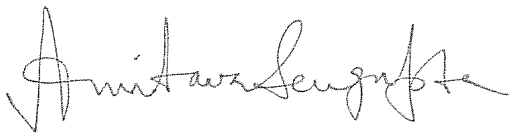
15. Eliminating the dual welding step required previously in membrane contactors, allowed the shell, end caps, tube sheets and plug to be made out of the same material.

16. Making the shell, end caps, tube sheets and plug of a membrane contactor out of the same material unexpectedly resulted in the membrane contactor obtaining better physical integrity of the device against temperature fluctuations, and solvent induced swelling of components. When the end cap and the shell wall are of the same material, a thermal welding produces a completely uniform joint, with the two welded components inter-melted together and there being no sign of any phase boundaries. This makes the entire finished product as if it was made from a single component and a finished product made from a single mold or machined from a single component is much stronger than a finished product that is made by attaching components of dissimilar materials.

17. Therefore, I must disagree with the Examiner's conclusion repeated above in Paragraph 4. Making a membrane contactor with the center tube plugged at the end where the hollow fiber lumens are open and having the center tube open at the end where the hollow fiber lumens is closed, allowing a single weld between the end caps and the shell, thus, allowing the shell, end caps, tube sheets and plug of a membrane contactor to be made out of the same material is not obvious.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,



Amitava Sengupta

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